

CONTEXTUAL FACTORS THAT CONTRIBUTE TO INCREASED RISK OF HIV AMONG TRANSGENDER AND
MSM SEX WORKERS AND RECOMMENDATIONS FOR SERVICE DELIVERY

William Meihack Miller

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Approved by:

William C. Miller

Sharon S. Weir

Clare Barrington

Michael E. Emch

Audrey E. Pettifor

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ABSTRACT

William Meihack Miller: Contextual factors that contribute to increased risk of HIV among transgender and MSM sex workers and recommendations for service delivery
(Under the direction of William C. Miller)

Globally, male-to-female transgender women and men who have sex with men (MSM) are at increased risk of HIV infection compared to the general population. Despite effective interventions to prevent HIV infection, the incidence among these populations continues to rise. The purpose of this dissertation was to 1) describe the MSM and transgender women missed through venue-based sampling and illustrate how data on venues frequented by MSM and transgender women can be used to prioritize delivery of HIV prevention services; 2) identify contextual factors that contribute to HIV risk among transgender sex workers in Guatemala City.

We recruited 1077 unique MSM and transgender women into two cross-sectional behavioral surveys using respondent-driven sampling (RDS) and time-location sampling (TLS) in Guatemala City. To compare the populations reached through RDS vs. venues, the outcomes included the number of partners, sex work, concurrent partners and sex with women. Additionally, access to HIV testing, free condoms, lubricant and IEC activities was analyzed. Contextual outcomes included discrimination, physical abuse, forced sex, rejection by family, drug and alcohol use and were measured through the behavioral questionnaire. Gender identity and sex work were combined to form the exposure.

RDS participants who did not frequent venues were older, had lower level of education, were more likely to identify as bisexual or heterosexual, have concurrent partners and sex with women compared to participants from venues.

The overwhelming majority of transgender women had received money for sex in the past year. Transgender sex workers were three times as likely to be discriminated against, seven times as likely to be physically abused and eight times as likely to be forced to have sex compared to MSM who did not sell sex. Binge drinking and illicit drug use were more common among transgender sex workers than among non-sex workers.

Transgender women in Guatemala and many other countries are affected by adverse life events that act as underlying determinants of HIV infection. Venues where transgender women and MSM can be reached are low-hanging fruit for HIV prevention programs and services should be offered following global guidance for key populations at increased risk.

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LIST OF ABBREVIATIONS

AIDS	acquired immunodeficiency syndrome
aPR	adjusted prevalence ratio
ART	antiretroviral therapy
CD4	cluster of differentiation 4
CDC	Centers for Disease Control and Prevention
CI	confidence interval
HIV	human immunodeficiency virus
IBSS	integrated bio-behavioral surveillance studies
IEC	information, education and communication
MSM	men who have sex with men
PLACE	priorities for local aids control efforts
PR	prevalence ratio
PrEP	pre-exposure prophylaxis of HIV
RDS	respondent-driven sampling
STI	sexually transmitted infection
TLS	time-location sampling
UNAIDS	Joint United Nations Programme on HIV
WHO	World Health Organization

CHAPTER ONE: SPECIFIC AIMS

HIV has had a disproportionate impact on men who have sex with men (MSM) and male-to-female transgender women in most countries. In 38 low- and middle-income countries, MSM were, on average, 19 times as likely to be infected with HIV than the general population.¹ Transgender women are 50 times as likely to be HIV positive compared to the general population.² In urban areas of developing countries, MSM and particularly transgender women engage in sex work to support themselves in the face of limited opportunities and employment discrimination, further increasing their exposure to HIV.³⁻⁷ Sex workers and transgender women fear or have experienced discrimination when accessing sexual health services,⁸⁻¹⁵ though increased perception of risk also promotes utilization of preventive services.¹⁶ To reach MSM and transgender women, social venues and sites where sex workers meet clients, or “hot spots” have long been targeted by program managers and outreach workers.¹⁷

In light of high HIV prevalence among transgender women, researchers have identified engagement in sex work, higher number of lifetime partners and unprotected receptive anal intercourse as possible reasons for increased risk.^{9,18,19} However, the reasons for transgender women’s high risk behavior are poorly described. In addition, prevention programs could better harness data collected at social venues and through social networks to develop novel interventions.

To shed light on the HIV epidemic among MSM and transgender women in Guatemala and in Latin America we will investigate: 1) the differences in the sexual behaviors and access to prevention services among MSM and transgender women recruited through respondent-driven sampling (RDS) vs. those recruited at social venues (time-location sampling (TLS)) and among TLS participants by the type

of recruitment venue and 2) demographic factors and adverse life events that act as underlying determinants of HIV infection among transgender women who receive money for sex.

Aim 1: Compare the sexual behavior and access to prevention services among the MSM and transgender women reached:

- a) through RDS who do not frequent venues vs. those reached through venue-based sampling;
- b) at different types of venues as part of venue-based sampling.

Aim 2: Identify demographic factors and adverse life events that act as underlying determinants of HIV infection among transgender women who receive money for sex compared to MSM who received money for sex and those who do not exchange money for sex.

CHAPTER TWO: BACKGROUND

Study Site

Guatemala is situated south of Mexico and north of El Salvador and Honduras. It was the heart of the Mayan civilization in the first millennium AD before colonization by the Spanish in 1524. During three centuries of Spanish rule, Guatemala was the capital of the Central American Captaincy General, an administrative district of New Spain covering Chiapas, Mexico, Guatemala, Honduras, El Salvador, Nicaragua and Costa Rica.²⁰ In 1821, the Captaincy General of Guatemala won its independence. The short-lived United Provinces of Central America was dissolved in 1840 and a series of authoritarian and democratic regimes followed.²⁰ Between 1944 and 1996 the country suffered under a 30-year civil war.²¹ Democratic but weak governments ensued since 1996 as Guatemala has attempted to recover from its violent, oppressive history.

The estimated population in 2010 for Guatemala was approximately 14 million people, of which 49% were men and 51% women. The average annual population growth was 2% from 1998-2010. Guatemala has a predominantly young population with 37% under 15 years and a median age of 21 years.^{22,23} Life expectancy was 69 years for men and 73 for women. In 2010, Guatemala was 116th in the human development index, ranking second lowest in Latin America and the Caribbean.²⁴ The per capita gross domestic product (GDP) was \$4,350 and the public expenditure in health was 2.5% of the GDP.²⁵ Nearly one quarter of the population above 15 years of age is illiterate and poverty levels show that 14% of the population lives on less than \$1.25/day, 3rd highest percentage in the region. The Gini index of inequality was 0.539, 4th highest in the region and 10th highest in the world.²³ Guatemala is one of few

countries in Latin America with a large indigenous population; currently 23 ethnic minorities are recognized each with its own language.

HIV is a growing health problem in Central America. For 2010, approximately 178,000 people were infected with HIV in Central America, largely concentrated in Guatemala (58,000; 33%), Honduras (26,000; 15%) and El Salvador (25,000; 14%).²⁶ As in most countries, many people are still unaware of their status as a total of only 29,000 cases were reported in Guatemala between 1984 and 2010. Nearly 13,500 people or 56% of those estimated in need antiretroviral therapy have access to treatment.²⁷ The male to female ratio has fallen from 5:1 in 1996 to 1.3:1 in 2010.²⁸ The declining male-to-female ratio of reported cases, together with an increasing number and visibility of women living with HIV infection in Guatemala, have been characterized as "heterosexualization" of the epidemic. However, in Central America as in most of Latin America, the epidemic still disproportionately affects traditional high-prevalence populations such as female sex workers and men who have sex with men.²⁹⁻³³ Based on antenatal care data, overall HIV prevalence in Guatemala has remained below 1%. HIV surveys among pregnant women have reported prevalence of 0.8% (n=1,309) in 1998, 0.3% (n=3,656) in 2000, 0.5% (n=7,008) in 2003, and 0.3% (n=1,190) in 2006.³⁴

Key populations at increased risk of HIV infection such as men who have sex with men (MSM), male-to-female transgender women, female sex workers, and people who inject drugs have been the subject of limited research and surveillance conducted in Guatemala. The multicenter study is the most cited source of HIV prevalence data among key populations but was completed more than a decade ago in 2001.³⁵ Based on the multicenter study, MSM from Guatemala City had an HIV prevalence was 12% (n=165). Subsequent sample of MSM yielded a prevalence of 18% (n=300) in 2006 and 8% in 2012.³⁶

The next sections will discuss the individual, network and community risk factors for HIV faced by MSM and transgender women. The categorization is based on the social ecological model³⁷ and Baral's modified social ecological model for MSM.³⁸

Individual Risk Factors

Sexually transmitted infections (including HIV) remain a major health problem for MSM (gay, bisexual and heterosexual-identifying men who have sex with men) and male-to-female transgender women. In addition to a higher prevalence of many common genital STI, rectal and pharyngeal infections are suspected to go undiagnosed. Most STI place an individual at increased risk for acquisition of HIV. The identification and treatment of STI in MSM is thus extremely important both for the individual's health and the general health of the community. MSM, and particularly HIV-positive MSM, have a higher incidence of precursor lesions and anal cancer as a result of infection with Human Papilloma Virus.³⁹ The pooled HIV prevalence among MSM in countries where studies were conducted between 2000 and 2006 was 13%, 19 times the prevalence in the general population.¹ The pooled HIV prevalence among transgender women was 19%, 50 times that of the general population in countries where prevalence studies were conducted between 2001 and 2011.² In China alone, MSM were 99 times as likely as the general population to be infected with HIV, 30 times as likely to be infected with syphilis, 13 times for gonorrhea, 10 times for Hepatitis C, 2 times for chlamydia.⁴⁰ STI prevalence among MSM and transgender women varies greatly from context to context and is clearly an important cofactor for HIV infection.⁴¹⁻⁴⁴

HIV and other STI are transmitted most often among MSM and transgender women through unprotected sexual intercourse. Unprotected anal intercourse is an efficient way to transmit the virus due to the thin epithelial membrane in the anal cavity, the lack of mucosal protection and the increased likelihood of physical damage to mucosal membrane during sex due to friction.⁴³ Additionally, as with

sexual intercourse between men and women, MSM and transgender women who have multiple sexual partners are at increased likelihood of transmitting or acquiring HIV and other STI.^{6,45,46} MSM who have only have male partners and those who engage in receptive anal intercourse are at increased risk compared to those that have sex with men and women and those that only practice insertive anal intercourse.⁴⁴

Further adding to HIV risk among MSM and transgender women, drug use among MSM is higher than in the general population.⁴⁷ In addition to the direct health effects of drug use and alcohol abuse, including addiction, there is high secondary risk for STI through increased sexual partnerships and inconsistent condom use as a result of the disinhibition and social contexts.⁴⁸ Drug use and alcohol abuse are associated with increased rates of high-risk sexual behavior, as well as sharing of infected injecting equipment.^{39,49} Use of illicit drugs as well as prescription erectile dysfunction drugs have been associated with UAI^{16,45,46,50-61} and HIV infection^{48,49,58,62,63}

Assuming a gender identity different from ones sex at birth is associated with multiple individual risk factors. When transgender women have been compared to MSM in simple bivariate analyses they had more lifetime partners but used condoms more often than MSM.^{9,18} In India, transgender women were more knowledgeable of HIV and simultaneously at greater risk of HIV infection^{18,64} while in Pakistan awareness of HIV was lower.⁶⁵

In many countries transgender women are more likely to sell sex, have a higher burden of HIV, and present more risky behavior overall.^{18,19} Risk factors are frequently interrelated, and among transgender women engagement in sex work has been seen to be associated with positive HIV status, use of street drugs (crystal methamphetamine, cocaine, heroin, ecstasy, GHB and ketamine), homelessness and a low educational level.^{16,54,66-70} Some have concluded that substance abuse is way to cope with sex work^{53,69} while others infer that substance abuse leads to risky situations and sex work

initiation.⁷¹ These interrelated risk factors have been shown to be additive, as a co-occurrence of factors, for HIV risk among transgender women.⁷²

Social and Sexual Network Level Factors

Social networks involve family, friends, neighbors and others that shape HIV risk for their members. Biological (e.g. HIV infection rates) or behavioral (e.g. sexual contact, sharing of injection equipment) risk factors facilitate HIV transmission within a network.³⁸ Networks characterized by sex work, drug use, high viral load or STI increase the probability of transmission within networks. Network size and density are other important network factors. Conversely, social networks can provide social support and serve as protective factors against HIV infection.

Among MSM and transgender women sex work has been associated with HIV acquisition⁵ and UAI.⁴ In China, MSM and transgender who sold sex were more likely to have higher income, use erectile dysfunction drugs and be younger, an example of where individual risk factors overlap in a high risk network to increase chances of HIV infection.⁹

In some cases transgender women lack a social support network⁷³ while in other cases they have an alternative support network⁷⁴⁻⁷⁶ In some instances, what would normally be a harmful network factor, such as engagement in sex work, has been associated with increased perception of social support among transgender women.¹⁶ Independent of the risk, sex work serves a solution for transgender women: proving elusive financial viability and validating much desired female gender⁵⁶ and as way to pay for body modifications.⁶⁹

Community Level Factors

Communities, as defined by social ties, relationships between organizations or geographic boundaries, can increase or mitigate HIV risk.⁷⁷ Community norms can affect acceptability and prevalence of condom use.^{78,79} Stigma, discrimination and violence are community factors that have

been associated with increased HIV risk among MSM and transgender women.⁸⁰⁻⁸⁴ MSM and transgender women have been found to hide their sexuality from family, friends and colleagues to avoid stigma or discrimination.^{46,72,85-87}

Based on interviews with transgender women, motivation for engaging in sex work is financial, a sign that employment in other less risky fields is unattainable or unprofitable.^{16,71,88,89} Transgender women experience educational and employment discrimination^{16,46,52,54,66,90-93}, family, school and social rejection,⁷⁴ as well as violence, forced sex, physical and verbal abuse.^{52,56,94,95} One risk factor can lead to another as random acts of violence from general public were found to be associated with drug use.⁶⁹

Due to the multiple sources of negative social reinforcement faced by MSM and transgender women, high rates of episodic and chronic mental illness are common. These vary from anxieties related to a daily life lived in secret; long-term depression and anxiety related to social isolation; post-traumatic stress related to physical or emotional violence, or loss of family; and many other effects on mental well-being. Psychosocial stressors such as verbal, physical and sexual abuse have been tied to risk taking behavior⁹⁶⁻⁹⁸ Stigma, discrimination and exclusion or fear thereof can lead to anxiety, depression, mental health disorders^{6,55,56,68,91,99-102} which have been found to be correlated with UAI.^{53,54,103} Similarly, sexual assault and partner violence have been seen to be associated with HIV status.^{55,58} Childhood sexual coercion is has been studied more recently and was shown to predict UAI^{58,104-106} Power relations between genders, a societal norm associated with HIV risk among heterosexual couples, also affected transgender sex workers in Pakistan where they reported less negotiating power for condom use.¹⁰⁷⁻¹⁰⁹

Stigma and discrimination in the community also affect MSM and transgender women's access to sexual health services. When asked about utilization of health services common themes include fear of disclosing behaviors, fear of denial of services/discrimination, financial barriers, poorly trained personnel in MSM/transgender sexual health issues, and a lack of MSM/transgender-specific health

facilities.^{8-14,110} On the other hand, engagement in sex work is, in some cases, associated with history of HIV testing among transgender women.¹⁶ HIV testing leads with reduced risk behaviors and early entry to care^{111,112} and is currently a major prevention strategy for all populations worldwide. High level of testing among transgender sex workers may indicate willingness to engage in risk reduction.¹⁶ Utilization varies greatly and in Indonesia HIV testing among transgender women and MSM is rare (3%) and contact with prevention programs (11% of MSM and 49% of transgender) is moderate.¹¹³ While three quarters of MSM in Guangzhou, China had accessed HIV prevention service in the past 12 months only 14% had been tested for HIV. AIDS awareness, HIV testing in the past 12 months and coverage of HIV prevention services were protective in relation to HIV and syphilis infection but not significantly so.⁴³

Stigma and discrimination often drive MSM and transgender women from rural to urban areas, where same-sex behavior is more acceptable and where social venues popular among MSM exist. Some social venues, such as saunas or bathhouses cater specifically to MSM looking for on-site sex. Venues such as bathhouses, parks and sex clubs permit anonymous, clandestine sex.¹¹⁴ Many social venues promote the acceptability of alcohol and drugs, an example of a community factor moderating the effect on an individual behavior on unprotected sex, number of partners and HIV infection. Venues can also be tapped as routes for HIV prevention intervention, particularly when data is available on venues or venue patrons.¹¹⁵

HIV risk often varies by the type of venues where people meet sexual partners. Most commonly, frequenting saunas is associated with HIV^{5,116-120} and syphilis infection.^{117,118} In China, MSM at saunas were found to be 15 times as likely to be HIV positive than MSM from bars.¹²¹ In a meta-analysis from China, MSM who met partners in saunas were at higher risk than those who met them through the internet ($OR_{HIV} = 2.3$; $OR_{syphilis} = 1.6$), bars ($OR_{HIV}=1.7$, $OR_{syphilis} = 1.4$) and parks ($OR_{syphilis} = 1.6$).¹²² Sauna attendees have more partners and higher frequency of UAI¹²³ – as a physical space with a sexual

atmosphere and HIV policies and norms related to sex in public areas and substance use.^{114,124-127}

Condom availability in saunas was shown to be inversely associated with UAI in Taiwan.^{128,129} In addition to saunas, meeting partners at bars or dance clubs was linked to HIV infection in Seattle (OR = 8.2)¹¹⁹ In China, men recruited at gay entertainment venues more likely to have sold sex, had more partners, sex with women, unprotected vaginal sex, erectile dysfunction and illicit drug use than men from community-based organizations.⁹

Since the invention of the internet, MSM have started using web sites and chat rooms to meet new partners, and in some settings those who meet partners over internet have more UAI, partners and are more likely to be infected with HIV than those who meet partners at other gay venues.^{138,139,119,130,131} In China, those who go to venues in addition to finding partners online have more partners than those that only go to venues or only use the internet to meet partners.¹³²

HIV risk related to venues is a public health concern as well as an opportunity to provide HIV preventive services. When social venues frequented by MSM and transgender women have been explored for HIV prevention activities, gay bars were seen as the easiest to identify compared to other venues; health education, condoms are rarely provided in parks and smaller venues and in China, and utilization of HIV-related services was found to be lowest in recreational centers and highest in saunas and bars.¹¹⁶ Prevention programs around the world should take advantage of social venues to offer HIV preventive services to MSM and transgender women, and programs could make better use of data on risk and health service utilization in addition to designing more creative interventions to reach venue patrons.

Syndemic

Singer and Snipes coined the term syndemic for the health crisis (co-occurrence of substance use, AIDS, and violence) among poor and underserved inner-city women in the early 1990s.¹³³ As

described by Singer, “a syndemic involves a set of enmeshed and mutually enhancing health problems that working together in a context of deleterious social and physical conditions that increase vulnerability, significantly affect the overall disease status of a population.”¹³⁴ Thus, a syndemic is more than the interaction of diseases; rather, it is the mutually reinforcing interaction of disease and social conditions.¹³⁴⁻¹³⁶

Psychosocial health problems, polysubstance use, depression, partner violence, and childhood sexual abuse were significantly and positively associated with high-risk sexual behavior (multiple partners and UAI) and HIV infection among urban MSM.^{55,58} Comorbidity research tends to focus on the sociological issues of boundaries and overlap of diagnoses, whereas syndemic research focuses on communities experiencing co-occurring epidemics that additively increase negative health consequences.¹³⁷

Among transgender women, four health and psychosocial factors including low self-esteem, polysubstance use, victimization, and intimate partner violence were found to have an additive relationship with HIV status and UAI.⁷²

Sampling Methods

The gold standard for acquiring HIV data is probability-based population surveys. However, due to the small population, residential dispersion and stigma, obtaining representative data on MSM and other key populations presents a methodological challenge. Researchers have used random-digit dialing to sample MSM from geographic areas known to have large gay populations.^{138,139} However, stigma and lack of financial independence in countries like Guatemala prevent MSM from concentrating in particular neighborhoods, mobile phones have replaced land lines making random-digit dialing impractical and random-digit dialing could always miss men who live outside gay-identified areas.¹⁴⁰ Since MSM and transgender women are often a relatively small proportion of the total population,

population-based surveys would need to be very large to include enough subjects for precise estimates. Moreover, due to the illegal and stigmatized nature of their behaviors, such populations are often under-recognized and under-reported in household, population-based surveys. On the other hand, recruiting subjects at locations where they are highly visible in large numbers, such as at service facilities or social venues, can be efficient but lacks validity in representation.

Several approaches have been proposed to balance the need for recruitment efficiency and inclusiveness in representation. Snowball sampling increases efficiency, identification, and inclusion of hidden populations by having members of the target population recruit other members.¹⁴¹ However, snowball sampling lacks validity in representation because the composition of the sample is dependent upon the choice of initial recruits or “seeds” and short recruitment chains, mostly the recruits of seeds.¹⁴² Time-location sampling (TLS) seeks to approximate probability sampling by mapping the universe of venues where the target population can be found in large numbers, randomly selecting the location, day and time for recruitment and systematically selecting participants from the venue.^{140,143} However, TLS only includes the population that frequents selected venues. A newer method known as respondent-driven sampling (RDS) lends statistical rigor to conventional snowball sampling through longer recruitment chains, recruitment limits, and the collection of data used to statistically adjust for the biases inherent in how people of similar characteristics are networked and likely to recruit each other.¹⁴⁴ RDS has been used for surveillance of key populations in the United States and in more than 83 countries worldwide.¹⁴⁵ Although statistical questions about RDS remain,^{146,147} there is a growing body of experience using the method.^{69,206}

The RDS methodology is based on recruitment of long chains whereby the initial recruits refer other members of the target population to the study. In contrast to conventional snowball sampling, recruitment is limited to a certain number of people (usually, two or three) in order to limit any

individual's influence on sample accrual. Additionally, information on linkages between recruiters and recruits and the size of participants' social MSM networks are collected to statistically adjust for recruitment biases.^{148,149} Relative social network sizes affect a person's probability of being recruited into the study and their ability to recruit others. An underlying assumption of RDS is that long-chain recruitment represents a first-order Markov process that reaches a dynamic equilibrium, therefore neutralizing the tendencies of people with similar characteristics to associate with each other (homophily).¹⁴⁸ Adjusted analyses are thought to reflect the underlying makeup of the target population when the sample reaches "equilibrium," that is, when additional waves of recruitment do not substantially change the composition of the sample with respect to key variables (e.g. socio-economic status). In practice, equilibrium is usually achieved in four to five waves for most variables.¹⁴⁸ Recruitment chains begin with seeds, people purposefully selected as members of the target population. Each seed receives 2 uniquely coded coupons to be used to recruit other participants. Eligible people who present with a coupon give consent, enroll, and in turn are given recruitment coupons until the sample size is reached.

The following assumptions apply to RDS for adjusted data to represent the target population: 1) Participants know each other as members of the target population; 2) networks forms one single large component; 3) the population is large enough for a sampling with replacement model to be appropriate; 4) respondents can accurately report their personal network size; 5) recruitment occurs randomly from the network. Each of these assumptions can be invalidated if 1) participants recruit strangers possibly due to lack of instruction or strong interest in secondary incentives; 2) subgroups of the target population are isolated due to socio-economic or geographic reasons and recruitment does not reach all subpopulations; 3) the population is too small or the sample size approaches the population size; 4) network size questions are asked inconsistently, for an inappropriate time frame or in a way that gives extreme values, small or large; 5) participants recruit based on convenience possibly due to poor

recruitment training or misaligned incentives. The RDS assumptions must be met for RDS to be a probability-based method, should be explored in the formative work before implementing a study and can be tested during recruitment. There is no perfect method for sampling MSM and RDS is one of few methods that approach representativeness.

A second sampling strategy used to recruit hard-to-reach populations is time-location sampling, a probability based method for enrolling members of a target population at social venues.^{140,150} It is a useful strategy for sampling MSM, because it focuses resources on places and times where MSM are expected to congregate. TLS and similar strategies such as Priorities for Local AIDS Control Efforts (PLACE) have also been used to sample female sex workers.¹⁵¹ However, the method has been used primarily in gay-identified areas of urban centers, where relatively hospitable field conditions prevail. Important questions remain about whether time-location sampling is feasible in less gay-identified areas, whether its samples are representative of the target population, and whether respondents interviewed in public places give honest and accurate sexual reports. Time-location sampling is essentially a 3-step procedure in which venues (e.g., bars, parks, clubs, and bathhouses) are the primary sampling units. Before venues can be sampled, researchers must conduct ethnographic or formative work to identify all potential venues where MSM socialize. Subsequently for the first stage of sampling, venues are randomly selected from a universe of vetted venues. Second, a specified day and time period associated with the venue is randomly selected. Third, selected venues are visited during the specified period, and those attending the venue are systematically approached and asked to participate. Ideally, every member of the target population has a known, nonzero probability of being selected; every person selected agrees to participate; and everyone tells the truth. In HIV prevention research with MSM, time-location sampling entails approaching men in public settings and asking about sexual practices, drug use, and other HIV risk factors, often within a few minutes of the initial approach. Sometimes participants are asked for a blood sample. Such field conditions pose many challenges.

Potential respondents typically are engaged in other activities, venues may offer little privacy, and individuals who decline participation cannot be systematically re-contacted as in telephone or household surveys. In the Young Men's Survey conducted in San Francisco and Berkeley, California, for example, approximately 2,000 young men were approached over a 32-week period in venues expected to yield large numbers of young MSM. Only 44% of the 1,773 men screened were eligible on the basis of age and residence and 61% of the eligible men agreed to participate.^{152,153} In the Guatemalan parent study, 2,901 men were approached, 55% (1,603) accepted the eligibility screening. Of these, 738 were eligible (46%), 628 agreed to participate (85%) and 609 (97%) were interviewed.¹⁵⁴ Although the response rate may be explained in part by demanding study requirements, these figures do not bode well for reaching large numbers of MSM outside gay areas.

Another issue concerns choice of venues. Achieving a representative sample requires not only high participation rates but also venues that are frequented by most of the target population. Surveying in "low yield" or difficult (e.g., unsafe) venues is costly, in terms of money, time, and staff morale. For these reasons, some studies like the Young Men's Survey in the U.S. and the Guatemalan parent study excluded settings expected to yield fewer than 2 eligible men per hour.^{150,154,155} Such exclusion criteria tend to rule out venues where most attendees report exclusively heterosexual behavior and gay-identified venues where attendance is sporadic or low. This raises 2 questions: (1) Are there sufficient venues to implement time-location sampling in areas with small and dispersed MSM populations? And (2) Does excluding small venues substantially bias study results? The accuracy of self-reports obtained in public settings is questionable, especially when questions pertain to private and often stigmatized behaviors. The problem of response bias may be magnified outside gay-identified neighborhoods, where concerns about homophobia and being overheard may be more pronounced. Thus, it is important to know whether reports of risky behaviors are substantially depressed when data are collected in public settings and when interviewers have relatively little time to establish rapport with participants.

We have witnessed increasing use of RDS and TLS recruitment in surveillance and research and a few comparisons of the two methods.^{154,156-159} This research will take a novel approach to comparing the two methods. We hypothesize that RDS and TLS recruit distinct populations from the target population of MSM from Guatemala City. Different behavioral paradigms in the two study arms would support this hypothesis and encourage researchers to choose a sampling strategy carefully based on the target sub-population of interest. Continuity of sampling strategies over time and utility of data to inform prevention programs as well as factors around implementation and logistics are key concerns when planning a study.^{154,156,159-161}

Innovation

Few studies have compared risk behaviors and underlying determinants of HIV infections among MSM and transgender individuals. HIV prevalence tends to be higher among transgender women compared to MSM though comparisons of sexual behaviors exhibited by MSM and transgender women are rare. To date, only two publications have addressed HIV risk among these populations in Guatemala.^{15,154}

Comparisons of social venue patrons' sexual practices and use of preventive services are scarce. Many organizations have implemented interventions at social venues to reach MSM, but they rarely use data on patrons' sexual risk behavior or utilization of preventive services to better tailor programs. This analysis would serve as an example that data on people at venues or who report frequenting venues can be harnessed to allow organizations to better focus interventions at venues frequented by people at highest risk and those with least access to preventive services.

CHAPTER THREE: RESEARCH DESIGN AND METHODS

General Plan of Work

We used the data from cross-sectional respondent-driven sampling (RDS) and time-location sampling (TLS) surveys conducted simultaneously in Guatemala City in 2010, to 1) compare participants' risk behavior and utilization of preventive services among populations recruited through RDS vs. TLS; and of participants recruited at of different types of social venues; and 2) compare male-to-female transgender women who engage in sex work to MSM sex workers and MSM-non sex workers.

Parent Study: RDS-TLS Comparison Study

The RDS-TLS comparison study was conducted to compare RDS and TLS as sampling strategies to recruit MSM and male-borne transgender women into HIV-related research and prevention programs. Tephinet, Inc. and Del Valle University of Guatemala, led by G Paz-Bailey, initiated a cross-sectional RDS and a TLS study on October 1, 2010 in Guatemala City with identical eligibility criteria and continuing enrolment until the desired sample size was reached (November 23, 2010 for TLS and December 17, 2010 for RDS).¹⁵⁴ Participants were allowed to enroll in both surveys if they happened to be recruited and consented to participate. In the RDS study, 8 initial participants with large social networks were selected by investigators to represent diverse socioeconomic and sexual identities, were asked to recruit 2 peers and each participant thereafter was given the same instructions. A computerized coupon system was used to track recruitment. In the TLS survey, MSM were recruited at randomly selected venues by field staff. Participants received educational materials and a gift for participating in the survey. Both surveys were administered using a Hand-held Assisted Personal Interview device (HAPI). The parent

study aimed to compare socio-demographic and behavioral characteristics, logistics, population size estimates, costs, and proportion of hidden MSM reached using each sampling strategy.¹⁵⁴

Study Population

Men recruited into either study must have been at least 18 years of age, residents of the greater metropolitan area of Guatemala City and have had anal sex with at least one male sexual contact in the past 12 months. Potential participants were excluded if considered too inebriated or drugged to coherently participate in the survey. To participate in the RDS study men must have had a valid coupon, and to participate in the TLS study men must have been recruited at a randomly sampled venue. All participants provided written informed consent for the behavioral interview.

Data Collection

Interviewers used a standard structured questionnaire for all eligible, consenting participants. In the TLS arm, potential participants were asked to step aside to for a private conversation where interviewers explained the risks and benefits of the study and asked for participants' consent. In the RDS arm, private rooms at the study site were available to screen participants for eligibility criteria and ask for consent. The face-to-face interviews lasted between 15 and 45 minutes. Questions covered sociodemographic characteristics, social network size, attendance of social venues, sexual history, recent male committed and casual partners, commercial partners, clients, knowledge of HIV transmission, history of STI, abuse, alcohol and drug use, access to HIV testing, condoms and informational or educational programs on HIV. No biological samples were taken as part of the study.

Statistical Analysis

Aim 1a: Compare the sexual behavior and access to prevention services among the MSM population reached through venue-based sampling vs. respondent-driven sampling;

Outcomes: more than 10 male partners, receiving money for sex, having concurrent partners, sex with a female partner, access to HIV testing, free condoms, lubricant and exposure to IEC, all within the past 12 months.

Sexual behaviors:

- More than 10 partners was assessed as, “In the past 12 months, how many male sex partners did you have?” resulting in a continuous variable with an inverse exponential form. This variable was recoded to a dichotomous variable for people with more than 10 partners vs. 10 or less in the past 12 months. Ten partners was chosen as a cut point based on the distribution values and our assumption that more than 10 partners in 1 year could be considered high exposure to HIV. All participants answered the first question and none were coded as missing.
- Received money for sex was assessed via, “Has a man ever paid you for sex?” and “In the past 12 months, has a man paid you for anal sex?” The second variable was recoded so that all people who have never been paid for sex were coded as not having been paid for sex in the past 12 months. All participants answer the question and none were coded as missing.
- Concurrent partners was assessed through a series of questions on the participants last 3 partners in the past 12 months. First we asked, “In the past 12 months, how many sex partners did you have?” For the most recent, second most recent and third most recent partner, as applicable for the past 12 months, we asked the month and year for “When did you begin having sex with [initials] your most recent sex partner?” and “When did you stop having sex with [initials] your most recent sex partner?” Participants for which the end date of a relationship overlapped with the start date of another relationship were considered to have concurrent partners. None of the participants were coded as missing.

- Sex with a female partner was assessed with the question, “Have you ever had sex with a woman?” and subsequently in reference to the past 12 months. A new variable was created in which all participants who had never had sex with a woman were coded as not having had sex with a woman in the past 12 months. One person did not answer the first question and was left as missing.

Prevention access:

- Access to HIV testing was assessed via, “Have you ever had an HIV test done?” The question was followed up by asking the day, month and year, “When was the last time you were tested for HIV?” The number of days since the participant’s last HIV test was calculated using the date of the interview. Participants who were tested between 0 and 365 days prior to the interview were considered tested for HIV in the past 12 months. The 12 month cut point was chosen based on global indicator reporting recommendations from UNAIDS. Twelve participants did not answer the first question, the date of the last test or the interviewer entered a date after the interview date and were coded as missing.
- Access to free condoms was assessed by, “In the past 12 months, did you receive any free condoms?” Due to a faulty skip pattern in the first month of the study 267 participants were not asked this questions. Multiple imputation was used to replace the missing values with an imputed value based on age, income, education and behavioral variables such as using paying for sex, receiving money for sex, sex with women, number of partners, access to HIV testing, IEC, etc. A total of 24 variables were used either for predictive purposes or because they had missing values to be imputed.

- Access to lubricant was assessed via, “In the past 12 months, have you received any of the following services at this clinic or NGO? And lubricant was read to the participant as one of the possible services. This variable was not recoded and three participants did not respond.
- Exposure to IEC was estimated through, “In the past 12 months, have you participated in any activity related to HIV and AIDS information or education (i.e. lectures, workshops)?” All participants answered the question.

Exposure: recruitment through TLS vs. RDS, and RDS participants were limited to those that had not gone to venues to socialize or meet sexual partners. The parent study paper compared all participants recruited through RDS to those recruited through TLS. This analysis is a variation on the parent study paper to better describe the participants who will be excluded from a venue-based survey, i.e. those recruited through RDS who do not frequent venues.

Bivariable Analyses

RDS recruits who reported not frequenting venues were compared to the TLS sample to answer the question of which sub-populations are missed by a venue-based approach.

TLS percentages were calculated using advance survey procedure where the venue-day-time event was the cluster and the month as a sampling frame was the strata. TLS sampling weights were calculated as the inverse of the product of three-stage selection probabilities, in which the stages comprised sampling of venues, venue-day-time units and participants.

RDS percentages were calculated for the sociodemographic factors and outcome using the Respondent Driven Sampling Analysis Tool version 7.1 (Cornell University, Ithaca, NY, USA) to adjust the RDS data for differences in network size and recruitment patterns. TLS analyses were performed using

SAS 9.4 (SAS Institute Inc., Cary, NC USA). Chi-square, z scores and respective p-values to compare RDS and TLS populations were calculated in Microsoft Excel as described below.

For dichotomous variables, unpooled Z tests were used to test for differences between survey-adjusted RDS and TLS proportions, where the test was constructed as the difference between the two estimates divided by the square root of the sum of their variances. Chi square tests were used to test for differences for categorical variables with 3 or more levels. The Chi square tests were adjusted for the complex sampling designs by dividing the Chi square test statistics by the average of the design effects from RDS and TLS for the variable under investigation.¹⁶² A comparison of the unweighted TLS and RDS-estimated proportions was not conducted since the purpose of this study was to evaluate differences in the MSM sub-populations reached by both sampling strategies and not in the samples themselves.

Sampling weights

For TLS, sampling weights were calculated as the inverse of the product of a three-stage selection probabilities, in which the stages comprised sampling of venues, VDTs and participants. Replacement VDTs were assumed to have the same selection probabilities as the originally selected VDTs. Sampling weights were adjusted for nonresponse and for unequal selection probabilities of venue attendees.¹⁶³ Men attend venues with different frequencies, and this results in frequent visitors having a higher chance of being selected to participate in the study due to the multiple venues, days and times attended. The different patterns of attendance result in multiple routes of selection for certain individuals. To adjust for multiple routes of selection, the sampling weights were divided by the product of the fraction of the year that the study occurred (53 days/ 365.25 days) and the self-reported frequency with which participants attended venues. Self-reported frequency of venue attendance ranged from “never” to “daily”, where “never” was assigned a value of 1.0 (as the participant was present at a venue at the time of sampling), and “daily” was assigned a value of 365. To approximate

the number of eligible MSM present at each VDT, the count of all males present at each recruitment event as recorded by study staff was multiplied by either (1) the relative proportion of eligible MSM at gay and mixed sites (a “mixed” site had both gay and non-gay attendees, such as a bar with 50 % gay attendees) or (2) the estimated proportion of MSM (roughly 3 %) in Guatemala city at public sites (e.g., malls and restaurants). Extreme weights were trimmed based on a method developed by Westat.¹⁶⁴

Aim 1b. Compare the sexual behavior and access to prevention services among the MSM population reached at different types of venues as part of venue-based sampling.

Outcomes: more than 10 male partners, receiving money for sex, having concurrent partners, sex with a female partner, access to HIV testing, free condoms, lubricant and exposure to IEC, all within the past 12 months. Described in detail above under Aim 1a.

Exposure: Type of recruitment venue in TLS, categorized by study staff as bar, club, restaurant/café, mall, park/street, sauna/hotel, or non-governmental organization (NGO). The categories, movie theater and internet café, were excluded venue due to the small number of participants recruited from these sites.

Univariable analyses for TLS sample

The percent of TLS recruits by the type of recruitment venue were calculated where \hat{p} is the percentage calculated by A / N , where A is the number of individuals with from the specific type of venue and N is the total number of participants.

The average number of potential MSM and transgender women at a site was measured by counting the number of men and transgender women that appeared to be over the age of 18 at the site during a four-hour visit. The enumerator, a field staff member was tasked with counting the number of men or transgender women who appeared over the age of 18 at the venue during the four hour visit. At

high traffic venues, the enumerator drew an imaginary line the floor and counted the men that crossed the line. At low-traffic venues, the enumerator counted the men in the area defined as the venue. The enumerator used a handheld ticker to count the men present at the venue-day-time event. The number of men present at each VDT event was averaged stratified by the type of recruitment venue. $\bar{e}_{bar} = \frac{\sum_{i=1}^n VDT_i}{n}$

The percent of eligible MSM ($\hat{p}_{eligible}$) was based on the average number of men and transgender women who met the eligibility criteria at a type of site (\bar{A}) divided by the average number of men approached during the four-hour visit (\bar{N}) ($\hat{p}_{eligible} = \frac{\bar{A}}{\bar{N}}$). All men approached at the VDT event would be screened for eligibility and all approaches whether eligible or ineligible would be stored in the database. The \bar{A} was calculated prior as the average number of eligible participants at the 69 VDT events stratified by type of site. \bar{N} was calculated prior as the average number of men approached at the 69 VDT events stratified by the type of site.

The estimated number of eligible MSM and transgender women by type of site ($N_{eligible}$) was calculated by multiplying the average number of potential participants enumerated at type of site (\bar{E}) by the percent eligible ($\hat{p}_{eligible}$). For example, $N_{eligible_{bar}} = \bar{E}_{bar} * \hat{p}_{eligible_{bar}}$

The percent of MSM and transgender women who have a large social network defined as knowing more than 100 MSM or transgender women in Guatemala City. Social network size was assessed through, “How many men who have sex with men and transgender women do you know and who know you and live in this city? How many of those are over 18 years of age? Of those who are over 18 years of age, how many of them have you seen or spoken to in the past 30 days?” The dichotomous variable for social network size larger than 100 was created and the percent of MSM and transgender women with a social network larger than 100 was calculated for each type of recruitment venue.

Bivariable Analyses

Bivariable analyses were conducted for the behavioral and prevention access outcomes by the type of venue where TLS participants were recruited.

Log binomial models were used to calculate prevalence ratios for behavioral and prevention access outcomes by the type of recruitment venue. General estimating equations (GEE) were used to account for correlation among participants recruited at the same venue-day-time event and TLS weights described above were applied.

Aim 2. Identify demographic factors and adverse life events that act as underlying determinants of HIV infection among transgender women and other MSM who receive money for sex

Participants recruited through RDS and TLS were combined to maximize the size of the transgender population. The analyses were carried out without weighting the sample for the probability of selection, as different methods exist for weighting RDS and TLS data. Participants who participated in both RDS and TLS arms were excluded (n = 38).

Outcomes: Drug and alcohol use: use of illicit drugs and binge drinking in the past 7 days. Adverse life events: feeling discriminated due to sexual orientation, physical abuse, being forced to have sex against one's will, all in the past 12 months and rejection by family due to participants' sexual identify.

Drug and alcohol use:

- Illicit drug use was assessed via, "Some people have used different drugs such as marijuana, cocaine, heroin, crack and other drugs. Have you ever used drugs? Yes or no" and to those who responded positively, "In the past 12 months, have you: smoked marijuana, smoked crack, inhaled crack, inhaled cocaine, injected cocaine, injected heroin, inhaled a thinner or glue, used poppers, used ecstasy, used amphetamines, used diazepam, used another drug." The variable

used for analysis was recoded as having used any of the above mentioned drugs in the past 12 months vs. no drug use for all participants. Six participants did not respond and were coded as missing.

- Alcohol use was assessed through, “During the past month, have you had any alcoholic drinks? Yes or no” and to those who responded affirmatively, “During the past month, how many times did you have 4 or more alcoholic drinks in one sitting?” The answer to the second question was collected as a continuous value and recoded for all participants including those who did not drink alcohol in the past 30 days as a dichotomous variable: ≥ 4 episodes of binge drinking in the past 30 days, i.e. at least one episode in the past 7 days vs. < 1 episode in the past 7 days. All participants responded to the questions on alcohol use.

Adverse life events:

- Feeling discriminated against was assessed by, “In the past 12 months, have you been discriminated or stigmatized because of your sexual orientation? By discrimination, we mean hitting, punching, kicking, threatening, nagging, scolding, or humiliating.” All participants responded and this variable was not recoded.
- Physical abuse was assessed, “What discriminatory act have you suffered” and the response options were: Physical abuse (hitting, punching, kicking); Verbal abuse (threats, scolding, humiliation); Extortion / Blackmail; Robbery or assault; Sexual violation; Other. A variable was created for participants who experience physical abuse in the past 12 months vs. not, where participants who did not feel discriminated against in the previous question were coded as not being physically abused.
- Forced sex was assessed as “Has anyone ever forced you to have sex with them against your will?” and for those who responded positively, it was repeated in regard to the last 12 months.

Participants who had ever been forced to have sex but not in the past 12 months were recoded as not having been forced to have sex in a new variable. Due to a faulty skip pattern 241 participants were not asked these questions in the first month of the study. Multiple imputation was considered to replace the missing values with an imputed value based on other variables not used given that models converged with the available data.

- Rejection by family was assessed through, “Has anyone in your family ever shown you contempt or rejection because of your sexual orientation?” Seven participants did not respond and were left as missing.

Exposure: Transgender identity and receiving money for sex in the past 12 months.

- Transgender identity was assessed through the question, “Among men who have sex with men there are those who identify themselves as gay, bisexual, heterosexual or transgender. How do you identify yourself?” The options given were: heterosexual, gay, bisexual, transgender (transsexual and transvestite were also part of the transgender option) and other. Interviewers read the five options and told the participant to choose one. Sex with another man in the past 12 months was part of the eligibility criteria, and among those eligible some identified as heterosexual. Participants who chose the option ‘other’ were asked to specify and the resulting text fields were recoded as one of the first four options based on the researchers’ interpretation of the response.
- History of sex work was assessed as “Has anyone ever paid you for anal sex?” For those who answered affirmatively, the question was repeated in reference to the past 12 months.

These two variables recoded as a combined categorical variable: 1) transgender with a history of sex work in the past 12 months (hereafter referred to as transgender sex worker); male-identifying MSM with a history of sex work in the past 12 months (hereafter referred to as male sex workers or cis-gender

sex workers); and 3) male-identifying MSM who did not sell sex in the past 12 months (hereafter referred to as non-sex workers or cis-gender non-sex workers).

Ideally, we would have made transgender women who did not engage in sex work a referent group. However, the sample size from this population was too small and we decided to exclude those participants from the analysis rather than group them with the cis-gender non-sex workers. The fact that half of the transgender women who had not received money for sex in the past year had engaged in sex work at some point in their lives supported the conclusion.

Covariates Sociodemographic and behavior variables:

- Age was collected by asking the participants' age. The relationship between age and the outcome
- Education was asked as "What is the highest level of education you have finished?" Options included: literate, primary, middle school, high school, university/postgraduate. This variable was recoded as: primary education or less; some or completed high school; and some or completed university education. One person did not respond.
- Income was collected as a continuous variable, for a month's wages and in the local currency. This variable was translated into U.S. dollars based on the exchange rate at the midpoint of the study. Due to the high number of possible responses, monthly income was recoded into 12 categories from 0 Quetzales/month to >8000 Quetzales/month (~US\$1000) in increments of 500 Quetzales from 1000 to 3000 and in increments of 1000 from 3000 to 6000 Quetzales and two final groups from 6001-8000 and 8001-50000 Quetzales. The categories were created based on the distribution of the original variable, identification of natural cut points and in categories with at least 40 observations. The final variable recoded as a normal distribution.

Bivariable Analyses

We presented the prevalence of transgender identity among participants and by the sociodemographic and behavioral variables mentioned above in contingency tables. Where \hat{p} is the prevalence calculated by A / N , where A is the number of individuals with the outcome (transgender identify) and N is the total number of participants.

Bivariable analyses were conducted using ANOVA for a difference in means, Kruskal-Wallis test for difference in medians and Cochran-Mantel-Haenszel general association test for difference in proportions. These tests were selected given that the exposure variable had 3 levels (transgender sex worker, male sex worker and non-sex worker). Bivariable log binomial models were used to calculate prevalence ratios and the respective confidence limits for most outcomes unless the small number of events required use of a Poisson model with robust variance estimates (physical abuse outcome). Prevalence ratios were calculated over odds ratios given that the survey was cross-sectional in nature and the prevalence of most outcomes were over 30%.

Multivariable Analyses

Multivariable log binomial models were used to calculate prevalence ratios and the respective confidence limits. Age, income and educational level were identified as potential confounders using directed acyclic graphs. The relationship between each outcome and continuous age, continuous income and ordinal education was assessed to determine the functional form and appropriate form for the each covariate in each multivariable model. The final models for each outcome are described below:

Drug and alcohol use:

- Illicit drug use:
 - Age: an inverse linear relationship between age and drug use. A continuous age variable was included.

- Income: Weak linear relationship between income and drug use. A continuous recoded income variable as described above was included in the model.
- Education: an inverse linear relationship between education level and drug use. A 3-level categorical education variable was included.

$$\text{Final model: } \ln(P(\text{drug_use}=1)|X) = \alpha + \beta_1(\text{transgender_SW}) + \beta_2(\text{male_SW}) + \beta_3(\text{age}) + \beta_4(\text{income}) + \beta_5(\text{primary}) + \beta_6(\text{high_school})$$

- Binge drinking:
 - Age: a weak inverse linear relationship between age and binge drinking. A continuous age variable was used.
 - Income: a weak linear relationship between income and binge drinking. A recoded income variable was included.
 - Education: Weak relationship between university education and binge drinking. A 3-level categorical education variable was included.

$$\text{Final model: } \ln(P(\text{binge_drinking}=1)|X) = \alpha + \beta_1(\text{transgender_SW}) + \beta_2(\text{male_SW}) + \beta_3(\text{age}) + \beta_4(\text{income}) + \beta_5(\text{primary}) + \beta_6(\text{high_school})$$

Adverse life events:

- Discrimination:
 - Age: A weak inverse linear relationship between age and having experienced discrimination. A continuous age variable was included.
 - Income: A inverse quadratic relationship between income and having experienced discrimination
 - Education: an inverse linear relationship between education level and discrimination. A 3-level categorical education variable was included.

Final model: $\ln(P(\text{discrimination}=1) | X) = \alpha + \beta_1(\text{transgender_SW}) + \beta_2(\text{male_SW}) + \beta_3(\text{age}) + \beta_4(\text{income}) + \beta_5(\text{income_squared}) + \beta_6(\text{primary}) + \beta_7(\text{high_school})$

- Rejection by family:

- Age: A weak inverse linear relationship between age and rejection by family. A continuous age variable was included.
- Income: No relationship between income and rejection by family. No variable for income was included.
- Education: Weak relationship between middle/high school and rejection by family. A 3-level categorical education variable was included.

Final model: $\ln(P(\text{rejection_fam}=1) | X) = \alpha + \beta_1(\text{transgender_SW}) + \beta_2(\text{male_SW}) + \beta_3(\text{age}) + \beta_5(\text{primary}) + \beta_6(\text{high_school})$

- Physical abuse:

- Age: No relationship between age and physical abuse. An age variable was not included in the model.
- Income: An inverse linear relationship between income and physical abuse. A continuous recoded income variable was included.
- Education: Inverse linear relationship between education and physical abuse. A 3-level categorical education variable was included.

Final model: $\ln(P(\text{physical_abuse}=1) | X) = \alpha + \beta_1(\text{transgender_SW}) + \beta_2(\text{male_SW}) + \beta_3(\text{income}) + \beta_4(\text{primary}) + \beta_5(\text{high_school})$

- Forced sex:
 - Age: Weak inverse linear relationship between age and having been forced to have sex. A continuous age variable was included.
 - Income: An inverse linear relationship between income and forced sex. A continuous income variable was included.
 - Education: An inverse linear relationship between education level and forced sex. A 3-level categorical education variable was included.

$$\text{Final model: } \ln(P(\text{forced_sex}=1) | X) = \alpha + \beta_1(\text{transgender_SW}) + \beta_2(\text{male_SW}) + \beta_3(\text{age}) + \beta_4(\text{income}) + \beta_5(\text{primary}) + \beta_6(\text{high_school})$$

Limitations

Behavioral survey data is inherently subject to social-desirability bias and recall bias. Social desirability bias is particularly problematic when dealing with sensitive topics such as sexual partnership and condom use and when interviews are conducted by an interviewer. To counteract this bias audio computer-assisted self-interviewing (ACASI) has been developed and widely used.^{165,166} In the parent study we decided to conduct face-to-face interviews for logistical reasons. While ACASI works well in an office or study site setting, use of a laptop in a venue for TLS would be complicated if not dangerous for study staff. We were not collecting biological samples and had no other reason to exit venues with participants where a mobile site would have been an alternative. To maintain similar standards for the RDS and TLS studies, we decided that interviewers should conduct face-to-face interviews using handheld computers similar to a smartphone or Palm device. Interviews could be downloaded on a daily basis to check quality and ensure no interviews were lost. Additionally, the devices were nondescript enough not to call attention to other patrons in venues or potential criminals.

As discussed in the sections on the sampling methods, there is no gold standard representative method for sampling MSM. The target population of venue-based methods is intrinsically those that frequent venues and therefore people who do not frequent identified venues are excluded. The representativeness of the venue-going population depends on the definition of “venue” and the thoroughness of the formative venue identification work. Participants may self-select by SES during consent screening and fear of stigma related to same-sex behavior may lead to high levels of non-response. RDS adjusted estimates are potentially biased when the major assumptions are not met: participants know each other as members of the target population; network forms one single large component; the population is large enough for a sampling with replacement model to be appropriate; respondents can accurately report their personal network size; recruitment occurs randomly from the network. During recruitment for the parent study, no excluded subpopulations were detected and 5 out of 8 seeds produced chains longer than 5 waves, the longest with 21 waves and 168 referrals. We have no reason to believe that RDS assumptions were not met. At the same time, since participants recruit subsequent participants, it is difficult to obtain non-response rates when using RDS and we cannot draw conclusion about the potential sample had all invited participants accepted.

All cross-sectional research is plagued by the inability to distinguish temporality of events and therefore presume causality. For example, we are unable to ascertain whether the exposure (acknowledgment of transgender identity and engagement in sex work) preceded the outcome (number of sexual partners in the past year or recent contact with preventive services) and therefore cannot assume that associations to be causal. At the same time, we asked about outcomes in the recent past in hopes that exposure would precede outcomes or at least occur over time simultaneously.

Finally, we can only allude to HIV risk through self-reported data on sexual behaviors and HIV status without assessing risk directly by way of serostatus. As an upcoming study among MSM in

Guatemala City planned to collect biological samples for HIV and STI testing and we did not want to provoke study-fatigue among the target population. The main objective of the parent study was to compare the two sampling strategies to determine which was best suited for recruiting MSM in Guatemala City, i.e. to inform the planning of the upcoming integration biological behavioural survey. Furthermore, collecting biological samples would have added logistical complications and costs that the parent study was not prepared to absorb.

CHAPTER FOUR: THE WHERE AND HOW FOR REACHING TRANSGENDER WOMEN AND MEN WHO HAVE SEX WITH MEN WITH HIV PREVENTION SERVICES IN GUATEMALA

Introduction

Male-to-female transgender women and men who have sex with men (MSM) and are at increased risk of HIV infection in countries worldwide. In low- and middle-income countries, such as Guatemala, transgender women are, on average, 50 times as likely and MSM are 19 times as likely to be infected with HIV than the general population.^{1,2} The HIV prevalence among MSM in Latin American and Caribbean countries varies greatly from 2% in Uruguay to 31% in Mexico with a median of 11%.³³ In 2013, the prevalence was 9% among MSM and 24% among transgender women in Guatemala City.¹⁶⁷ The importance of intervening among MSM and transgender women to prevent HIV infection has been extensively recognized among donors and national governments.¹⁶⁸

In the U.S., venues where MSM socialize, meet new partners or have sex were identified early in the epidemic as locations to collect surveillance data and to prevent new infections.¹²⁰ Venue-based sampling such as time-location sampling (TLS) has been used to recruit MSM and transgender women and inform prevention programs in numerous countries.¹⁶⁹⁻¹⁷¹ In countries where social stigma and homophobia makes recruitment of MSM and transgender women in venues infeasible or unrepresentative, convenience or respondent-driven sampling (RDS) has been used to inform HIV prevention programs.¹⁷²⁻¹⁷⁵ However, methods to identify subpopulations at increased risk and tailor interventions to specific types of venues have not been described.

In 2010, MSM and transgender women in Guatemala City were recruited simultaneously into an RDS and a TLS behavioral surveillance survey to compare the efficiency of the two methods and

differences in the populations recruited.¹⁵⁴ This study examines the value of surveillance data collected from MSM and transgender women through RDS and venues for the design of prevention programs. The objectives are to compare the sexual behavior and access to prevention services among the MSM and transgender population reached through 1) venue-based sampling vs. respondent-driven sampling; and 2) different types of venues as part of venue-based sampling.

Methods

Parent study

The RDS-TLS comparison study was conducted in 2010 to compare RDS and TLS as sampling strategies to recruit MSM and transgender women into HIV-related research and prevention programs.¹⁵⁴ Recruits from either study were at least 18 years of age, residents of the greater metropolitan area of Guatemala City and had at least one male sexual contact in the past 12 months. All participants provided written informed consent for the behavioral interview. The study was approved by the U.S. Centers for Disease Control and Prevention's Global AIDS Program Associate Director for Science Office and the Del Valle University of Guatemala's institutional review board. Interviewers gave the same questionnaire to all eligible, consenting participants. Questions covered sociodemographic characteristics, attendance of social venues, sexual history, condoms use with different types of partners, access to HIV testing, condoms and information/education/ communication programs (IEC) on HIV.

Measures

Sexual behavior and HIV prevention access outcomes were measured based on the behavioral questionnaire, administered by trained interviewers at sites frequented by MSM and transgender women (TLS survey) or at the RDS study site (RDS survey). In the current study, the outcomes of interest include: more than 10 male partners, receiving money for sex, having concurrent partners, sex with a

female partner, HIV testing, receipt of free condoms and lubricant and exposure to peer or outreach workers providing IEC, all within the past 12 months.

Exposure variables include: type of recruitment venue in TLS, categorized by study staff as club, bar, mall, restaurant/café, sauna/hotel, street/park or non-governmental organization (NGO). The categories, movie theater and internet café, were excluded due to the small number of participants recruited from these sites. The average number of potential participants at a site was measured by counting the number of men and transgender women who appeared to be over the age of 18 at the site during a four-hour visit. The percent of eligible participants was based on the number of men and transgender women who met the eligibility criteria divided by the number of people approached during the four-hour visit. The estimated number of eligible MSM and transgender women per site was calculated for each site by multiplying the number of men enumerated at a site by the percent eligible. The number of MSM and transgender women at each site and by each type of site is helpful to plan for mobile service delivery, e.g. the number of outreach workers, condoms, HIV tests or other supplies needed.

Statistical analysis

RDS participants who did not frequent venues were compared to the TLS participants to answer the question of which sub-populations are missed by a venue-based approach. TLS subpopulations were characterized on sexual behaviors and access to prevention services by the type of recruitment venue.

For bivariable analyses, TLS percentages were calculated using survey procedures with the venue-day-time event as the cluster and the month as the stratum. TLS sampling weights were calculated as the inverse of the product of three-stage selection probabilities, in which the stages comprised sampling of venues, venue-day-time units and participants. The adjustment of the sampling weights was described previously.¹⁵⁴ RDS percentages were calculated for the sociodemographic factors

and outcomes using the Respondent Driven Sampling Analysis Tool version 7.1 (Cornell University, Ithaca, NY, USA). TLS analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC USA). Chi-square, z scores and respective p-values to compare RDS and TLS populations were calculated in Microsoft Excel as described previously.¹⁵⁴

Log binomial models were used to calculate prevalence ratios for behavioral and prevention access outcomes by the type of recruitment venue. General estimating equations (GEE) were used to account for correlation among participants recruited at the same venue-day-time event and TLS weights were applied. This secondary analysis was approved by the institutional review board at the University of North Carolina at Chapel Hill.

Results

RDS participants vs. TLS participants

Most RDS participants reported frequenting venues to meet new partners or socialize. As expected, RDS participants who did not go to venues were somewhat different from their TLS counterparts. RDS recruits who did not frequent venues were older, less likely to have a university education and were less likely to identify as gay (Table 1). With regard to their sexual behavior, the RDS recruits who did not frequent venues were more likely to have concurrent partners (57 vs. 33%, $p = 0.02$), have received money for sex (46 vs. 28%, $p = 0.1$) or have sex with women (49 vs. 27%, $p = 0.03$).

There were no differences in access to HIV prevention services. Among RDS participants who did not frequent venues, 54% were tested for HIV in the past year compared to 62% from TLS. Seventy percent vs. 73% received free condoms and 61% vs. 69% received free lubricant among non-venue-going RDS and TLS participants, respectively. IEC efforts reached 55% of RDS participants who did not frequent venues vs. 44% of TLS participants.

Venue recruitment patterns

TLS participants were recruited primarily in clubs and at street or park sites (Table 2). Smaller proportions were recruited at bars, movie theaters, malls, restaurants/cafes, internet cafes, saunas/darkrooms/hotels/spas and NGOs. Parks, streets and malls are high volume sites but low eligibility meant it would be difficult to target MSM specifically. At NGOs, saunas, hotels and clubs, over 80% of men interviewed were eligible, i.e. MSM or transgender women. However, saunas and hotels are estimated to have an average of 16 MSM at a busy time while clubs average 132 MSM. On the other hand, MSM interviewed at NGOs report the highest number of MSM and transgender women peers, peers who could be potentially reached through a social network-based intervention.

TLS participants recruited at NGOs, streets, parks, saunas and hotels were more likely to have more than 10 male partners, receive money for sex or have concurrent partners in the past 12 months compared to people from bars (

Table 3). Men and transgender women at these types of venues were considered at high risk and hence in need of prevention interventions.

Participants recruited at NGOs had the best access to HIV prevention services with overall coverage greater than 85% while HIV testing was low among men from restaurants and cafes and access to free condoms was also low among men at malls, saunas and hotels (Table 4). Additionally, those recruited in parks or on streets were less likely to be exposed to an IEC intervention in the past year.

Discussion:

In Guatemala City, different men and transgender women were reached with RDS compared to TLS. A younger, more affluent, better educated, gay-identifying population was more likely to frequent venues known to the MSM and transgender populations, and RDS participants who did not frequent venues were more likely to be older, less educated, less affluent and more likely to identify as

heterosexual or bisexual. Based on the behavioral self-report, the non-venue-going RDS population was more likely to have concurrent male partners, female partners, and to sell sex. Social network based interventions may be able to reach these sub-groups more efficiently.

RDS and TLS have been shown to reach different sub-populations.¹⁷⁶⁻¹⁷⁸ Comparisons of RDS and TLS populations of black MSM in San Francisco, CA, USA and MSM in Fortaleza, Brazil concluded that RDS was more effective at reaching low SES and bisexual men.^{156,159} However, in Shenzhen, China, TLS reached an older, less educated, bisexual population of MSM who do not sell sex though HIV prevalence was similar when compared to the RDS population.¹⁷⁹ Characteristics of the populations reached using a venue-based or social network-based approach has implications for delivery of prevention services and the ability to tailor interventions for specific sub-groups.

TLS recruits from saunas, hotels, streets and parks had more of sexual partners, were more likely to have concurrent partners and to receive money for sex. Saunas or bathhouses are historical hotspots for HIV and STI transmission among MSM in the U.S. and in China where men at saunas were 15 times as likely to be infected with HIV compared to those at bars.^{5,116-121} Parks and streets are known as principal venues for sex work by both men and women in Guatemala City.

Based on our analysis, NGOs are effective at reaching men and transgender women at highest risk as seen by the higher number of sexual partners and prevalence of sex work. NGO also reached people who have large social networks, over half of whom knew more than 100 MSM and transgender women. Prevention programs may be able to take advantage of NGO patrons' social networks to reach a larger, broader population for delivery of all services, including HIV testing, and linkages to HIV care.¹⁸⁰

Limitations

Interviewers in the TLS study arm may have introduced selection bias by approaching men whom they thought were likely to be eligible resulting in a high number of estimated eligible MSM and

transgender women at high-traffic mall and street sites. To counter this bias, interviewers were trained to systematically approach men who looked at least 18 years old and initiate eligibility screening. Preferential recruitment would have led to a lower percentage of heterosexual- or bisexual-identifying MSM in the TLS survey and would overestimate the number of eligible MSM and transgender women from sites. That said, it is expected that MSM who identify as heterosexual or bisexual will be less likely to admit to same-sex behavior when interviewed in a public venue and would be more difficult to reach through a venue-based approach. All participants were interviewed face-to-face, a potential source of social-desirability bias. This would lead participants to underestimate risk practices. However, careful selection and training of interviewers was carried out to establish rapport with participants and hence reduce bias. Recall bias could have affected data on events that occurred months or years before the study took place leading to underestimates of prevention coverage and sexual partnerships. Though, all questions referred to events in the 12 months to minimize bias. Finally, no biological endpoints were measured as part of this study and therefore risk of HIV infection can only be inferred through behaviors known to be risk factors.

Recommendations

We cannot be certain whether these differences in populations by type of recruitment will generalize to other settings, but these findings do suggest the importance of carefully assessing the groups reached by different strategies. Program managers should collect and use data on venues, people who frequent them and those who do not to identify gaps in program coverage and sub-populations at increased risk. Data on venues for prioritization of prevention intervention delivery are key for optimal use of resources and greatest impact.¹¹⁵ Venues where MSM and transgender women socialize are low-hanging fruit for HIV preventions services such as condom and lubricant distribution, HIV testing and linkage to care, community empowerment, violence prevention, harm reduction, PEP and PrEP. Given the number of MSM and transgender women enumerated and the percent eligible for

the study, it is likely that service delivery at clubs will offer a higher yield in terms of people reached compared to other venues. To reach MSM and transgender women in Guatemala City with the greatest number of partners and those most likely to sell sex, prevention programs should offer a complete selection of services at NGOs, saunas, hotels, streets and parks. Men and transgender women with the largest social networks were interviewed at NGOs, parks and streets (Table 2). Social networks can be harnessed to reach more hidden populations who identify as bisexual or heterosexual and people who do not frequent social venues. (Figure 1).¹⁸¹

HIV rapid tests, point of care CD4 and viral load assessment allow program managers to take more services to the population in need rather than wait for patients to materialize at clinics. To reach the 90-90-90 goals for awareness of HIV status, sustained ART and viral suppression set by UNAIDS, programs will need to be proactive in their efforts.¹⁸² Organizations implementing prevention programs for MSM and transgender women could harness data on venues to make condoms and lubricant available at venues frequented by these populations, particularly in venues where the patrons have a higher numbers of partners, are more likely to sell sex and have concurrent partners. Mobile HIV testing, referral to HIV care, information on PrEP and hotlines for PEP can also be delivered at venues as a way to increase uptake of biomedical interventions.

Tables and Figures:

Table 1. Comparison of MSM and transgender women recruited through RDS who do not frequent venues to the TLS sample

Variable	RDS non-venue frequenting (n= 106) %	TLS (n= 609) %	p-value
Age			
18-24	37.1	39.8	0.1
25-34	28.6	42.1	
35+	34.4	18.1	
Education			
Primary education or less	29.3	18.4	0.002
At least some secondary education	59.9	55.1	
At least some university education	10.8	26.5	
Monthly income			
<\$300	73.6	55.2	0.5
\$300-500	17.7	24.4	
\$501-800	5.5	13.2	
>\$800	3.2	7.1	
Sexual identity			
Hetero/bisexual	59.5	42.8	0.01
Gay	25.6	49.0	
Transgender	14.9	8.2	
Sexual behaviors, past 12 months			
>10 male partners	19.5	26.5	0.4
Sold sex	45.6	28.4	0.1
Concurrent sexual partners	56.7	32.7	0.02
Sex with women	49.1	27.1	0.03
Prevention access, past 12 months			
HIV testing	54.1	62.3	0.4
Free condoms	69.6	73.1	0.7
Lubricant from HF or NGO	61.4	69.4	0.4
Participated in IEC activity	55.7	44.3	0.2

HF = Health facility; NGO = Nongovernmental organization

Table 2. Type of venues where TLS participants were recruited, estimated MSM and transgender women per venue and percent of participants with a large social network of MSM

Type of venue	Recruitment venue		Average enumerated potential MSM per site*	Eligible MSM	Estimated eligible MSM per site	Large social network¶
	n	%	(A)	% (B)	(A x B)	%
Club	165	27.1	160	82.9	132	4.5
Bar	71	11.7	170	41.8	71	6.8
Movie theater	7	1.1	79	72.7	57	0.0
Mall	62	10.2	†802	26.1	209	7.0
Restaurant/café	54	8.9	134	61.1	82	11.9
Internet café	13	2.1	33	32.0	10	1.7
Sauna /hotel	44	7.2	18	91.9	16	18.6
Park/street	135	22.2	†680	39.0	265	20.3
NGO	58	9.5	43	92.4	40	56.1
Total	609	100.0	316	51.0	161	14.1

Note: MSM refers to men and transgender women who have sex with other men; * In a 4-hour period considered to be a time when many MSM are likely to be present; ¶ Defined as knowing more than 100 MSM or transgender women in Guatemala City;

† Due to high pedestrian traffic.

Table 3. Sexual behaviors in past 12 months among TLS recruits by type of recruitment venue

Recruitment Venue	>10 partners			Received money for sex			Concurrent partners			Sex with women		
	%	PR	95% CI	%	PR	95% CI	%	PR	95% CI	%	PR	95% CI
Bar	9.4	1 (Ref)	--	1.6	1 (Ref)	--	18.3	1 (Ref)	--	17.3	1 (Ref)	--
Club	11.9	1.3	0.2, 8.6	20.5	12.8	2.2, 74.6	40.1	2.2	0.9, 5.2	22.5	1.3	0.4, 4.2
Restaurant/cafe	5.1	0.5	0.1, 2.5	5.2	3.3	0.8, 13.7	22.0	1.2	0.5, 2.6	27.3	1.6	0.7, 3.4
Mall	11.9	1.3	0.3, 6.3	8.0	5.0	0.8, 31.4	47.4	2.6	1.2, 5.7	8.2	0.5	0.1, 1.8
Park/street	45.5	4.8	1.3, 17.8	49.8	31.0	7.9, 121.4	35.0	1.9	0.8, 4.4	37.1	2.1	0.8, 5.9
Sauna/hotel	37.5	4.0	0.9, 18.4	54.1	33.7	7.4, 153.0	47.8	2.6	1.2, 5.8	31.0	1.8	0.4, 7.5
NGO	62.0	6.6	1.4, 30.8	76.4	47.6	11.5, 197.4	26.6	1.5	0.7, 2.9	11.2	0.6	0.2, 2.0

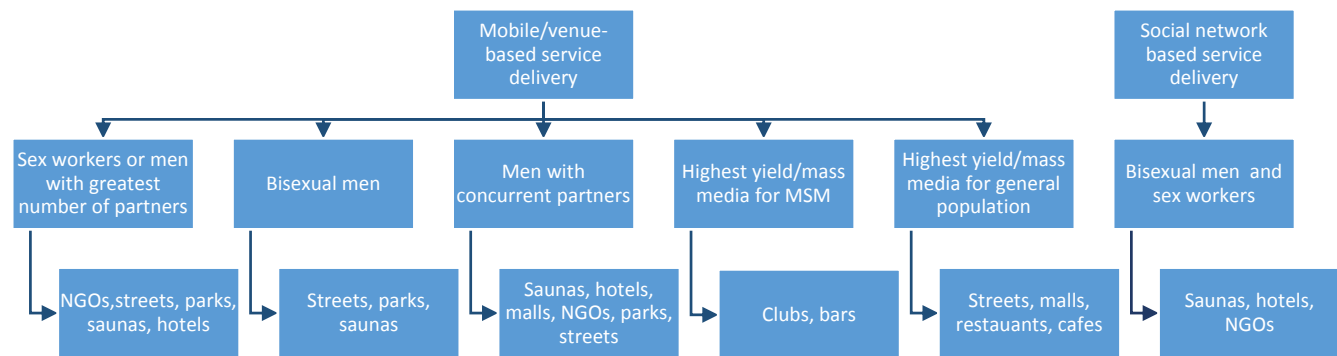
PR: prevalence ratio; Bold: p<0.05;

Table 4. Exposure to prevention services, past 12 months, TLS recruits by type of recruitment venue

Recruitment Venue	Tested for HIV			Received free condoms			Received lubricant			Exposed to IEC		
	%	PR	95% CI	%	PR	95% CI	%	PR	95% CI	%	PR	95% CI
Bar	76.0	1 (Ref)	--	64.1	1 (Ref)	--	77.6	1 (Ref)	--	57.6	1 (Ref)	--
Club	49.0	0.6	0.4, 1.1	89.5	1.4	1.0, 1.9	67.3	0.9	0.6, 1.2	42.3	0.7	0.4, 1.4
Restaurant/cafe	40.5	0.5	0.4, 0.8	58.7	0.9	0.6, 1.5	62.8	0.8	0.6, 1.1	49.3	0.9	0.6, 1.3
Mall	63.0	0.8	0.6, 1.2	58.4	0.9	0.5, 1.6	52.1	0.7	0.4, 1.1	47.4	0.8	0.4, 1.6
Park/street	67.4	0.9	0.7, 1.2	79.2	1.2	0.9, 1.7	73.8	1.0	0.7, 1.3	35.6	0.6	0.4, 1.0
Sauna/hotel	79.0	1.0	0.8, 1.3	53.8	0.8	0.4, 1.9	55.8	0.7	0.4, 1.2	75.5	1.3	0.8, 2.2
NGO	84.9	1.1	0.9, 1.3	89.0	1.4	0.9, 2.0	94.7	1.2	1.0, 1.5	88.7	1.5	1.1, 2.2

PR: prevalence ratio; Bold: p<0.05;

Figure 1. Illustrative decision tree for delivery of prevention services to subpopulations of MSM and transgender women in Guatemala City



CHAPTER FIVE: SEX WORK, DISCRIMINATION, DRUG USE AND ABUSE: A SYNDEMIC FOR HIV RISK AMONG MALE-TO-FEMALE TRANSGENDER WOMEN IN GUATEMALA

Introduction

Male-to-female transgender women are disproportionately affected by HIV and other sexually transmitted infections (STI) worldwide. The HIV prevalence among transgender women in Latin American countries varies from 19 to 34%.² In 2013, the prevalence of HIV among transgender women in Guatemala was 24% compared to 0.7% among the general population.¹⁶⁷ Among transgender women, the probability of HIV infection is increased through social network and community factors including stigma and discrimination based on gender identity, urbanization and social norms and substance use at social venues that influence the likelihood of sex work, casual sex and condom use.^{38,59-61,68,183-187} Globally, transgender women who exchange money for sex have a higher prevalence of HIV than transgender women who do not engage in sex work, female sex workers, and male sex workers.¹⁸⁸ Transgender women are also at increased risk of mental disorders such as anxiety and depression which can act as barriers to healthy sexual behavior.^{53,54,85,87,103} Rejection by family and friends or the fear thereof is one potential cause of mental illness among these populations. The co-occurrence of psychosocial issues and substance abuse among transgender women has been described previously as a syndemic.^{55,58,72}

The synthesis of sex work, social and behavioral factors is the basis of HIV risk among transgender women in Guatemala and Latin America. Gender discrimination affects educational and employment opportunities for transgender women leading to exchange of money or goods for sex.^{16,46,54,66,90} The combination of sex work and strong societal discrimination often leads to abuse and violence towards transgender women which negatively affects general health and increases their risk of

acquiring or transmitting HIV.^{52,56,94,95} Physical and verbal abuse, sexual coercion, sexual abuse, and discrimination are common for transgender women during childhood and adulthood.^{72,94,95,185,189-195} In El Salvador, transgender women were more likely to use drugs and alcohol compared to gay or heterosexual identifying MSM.¹⁷⁵

Although the disproportionate burden of HIV infection among transgender women is well-documented, the reasons for transgender women's high risk are poorly described. The objective of this study was to identify demographic factors and adverse life events known to be underlying determinants of HIV infection among transgender women who receive money for sex as compared to male sex workers and MSM who do not exchange money for sex.

Methods

Transgender women and MSM were recruited into two cross-sectional surveys one using respondent driven sampling (RDS) and the other time location sampling (TLS) in Guatemala City from September to December, 2010. For the RDS arm, 6 initial and 2 additional seeds were selected with guidance from NGO that worked with MSM with the intention of selecting seeds with diverse socio-demographic and sexual orientation profiles that had large social networks. Each participant was given 2 coupons to recruit MSM or transgender women they have seen or talked to in the past 30 days. Participants were enrolled at a single study site located at an NGO that provided primary care and HIV prevention and treatment services to the general population and had specialized services for key populations. Participants received a primary incentive valued at 6 U.S. Dollars (USD) and secondary incentives valued at USD 4 for each eligible recruit who enrolled.

In the TLS arm 40 venues were randomly selected without replacement each month for two months and one 4-hour venue-day-time unit was selected randomly for each venue. Replacement venue-day-time units were selected for each primary venue-day-time event and used when sampling

could not be conducted at the original venue. Venues were selected from 54 eligible venues identified during the formative research. Eligible venues were estimated to yield at least 7 eligible men or transgender women during the 4-hour sampling event, were deemed safe by study staff and permission was granted to conduct the survey by the site manager or owner. At each recruitment venue, interviewers approached participants systematically, provided information about the study, applied a written informed consent process, administered the questionnaire using a handheld computer and distributed educational materials and the primary incentive worth USD 6. The number of men present at each venue and limited data on men who refused to participate were also collected. RDS and TLS recruitment procedures were described previously.¹⁵⁴

Men and transgender women included were at least 18 years of age, residents of the greater metropolitan area of Guatemala City and had at least one male sexual contact in the past 12 months. All participants provided written informed consent for the behavioral interview. The study was approved by the U.S. Centers for Disease Control and Prevention's Global AIDS Program Associate Director for Science Office, the Del Valle University of Guatemala and the University of North Carolina at Chapel Hill's institutional review board.

Measures

Trained field staff interviewed all eligible, consenting participants using a standardized questionnaire. Questions covered sociodemographic characteristics, sexual history, drug use, alcohol abuse, discrimination and adverse life events.

Outcomes measures included binge drinking, use of illicit drugs, feeling discriminated due to sexual orientation, physical abuse and being forced to have sex against one's will, all in the past 12 months. Binge drinking was defined as at least one episode in the past 7 days in which the participant

consumed four or more alcoholic beverages in one sitting. Rejection by family due to participants' gender identity was measured through the questionnaire and also considered an outcome.

The exposure variable was combined from gender identity and recent history of sex work: transgender, transvestite or transsexual identity (hereafter referred to as transgender) and having received money for sex in the past 12 months. Men who identified as gay, bisexual or heterosexual were assumed to identify with the male gender, hereafter referred to as cisgender men. Among cisgender men a category was created for male sex workers and non-sex workers. Transgender women who did not receive money for sex were excluded from the analysis due to the small sample size.

Statistical analysis

Participants recruited through RDS and TLS were combined to maximize the size of the transgender population. The analyses were carried out without weighting the sample for the probability of selection, as different methods exist for weighting RDS and TLS data. Participants who participated in both RDS and TLS arms were excluded (n = 38).

Bivariable analyses were conducted using ANOVA for a difference in means, Kruskal-Wallis test for difference in medians and Cochran-Mantel-Haenszel general association test for difference in proportions. Bivariable and multivariable log binomial models were used to calculate prevalence ratios for the most outcomes unless the small number of events required use of a Poisson model with robust variance estimates (the physical abuse outcome). Models were adjusted for age as continuous variable based on the relationship between age, the outcome and the exposure; monthly income as a categorized continuous variable or quadratic variable based on the relationship between income, the outcome and exposure; and educational attainment as a categorical variable.

Results

Relationship between transgender identity, sex work and sociodemographic variables

Of the 1077 de-duplicated participants recruited in Guatemala City, 13% (n = 142) self-identified as transgender and 87% (n = 929) as cisgender. Sex work in the past year was common among transgender participants (86%, n = 122), whereas 30% (n = 280) of cisgender participants had received money for sex in the past 12 months and 70% (n = 649) had not sold sex and were considered the referent. Among transgender women who did not receive money for sex in the past year (n = 20), 45% did so prior to the past year.

Male sex workers were youngest with a mean age of 26.6, followed by transgender sex workers, averaging 27.1 years and non-sex workers at 28.1 (p = 0.03). Transgender and male sex workers had similar levels of education – most had completed at least some secondary education and few had any university education; non-sex workers were more likely to have a university education (Table 5). Male sex workers had the lowest median monthly income (250 USD) while non-sex workers had the highest (375 USD) and transgender sex workers in between (312 USD).

Relationship between transgender identity, sex work, drug and alcohol use

Transgender sex workers were more likely to have recently used illicit drugs compared to non-sex workers both in the bivariable model and after adjusting for age, income and education level (PR = 2.5, 95% CI: 1.9, 3.2; aPR = 2.6, 95% CI: 2.0, 3.5) (

Table 6). Transgender sex workers were marginally more likely to have used illicit drugs compared to male sex workers (PR = 1.3, 95% CI: 1.0, 1.7; aPR = 1.2, 95% CI: 0.9, 1.6). Binge drinking was also more common among transgender sex workers (PR = 1.4, 95% CI: 1.1, 1.8; aPR = 1.5, 95% CI: 1.2, 2.0) compared to non-sex workers.

Relationship between transgender identity, sex work and adverse life events

Transgender sex workers were three times as likely to be discriminated against (PR = 2.9, 95% CI: 2.4, 3.4; aPR = 2.7, 95% CI: 2.2, 3.2), seven times as likely to be physically abused (PR = 9.3, 95% CI: 5.6, 15.6; aPR = 7.3, 95% CI: 4.3, 12.3) and nearly eight times as likely to be forced to have sex (PR = 6.5, 95% CI: 3.0, 14.2; aPR = 7.5, 95% CI: 3.1, 18.2) compared to non-sex workers (Table 7). Additionally, transgender sex workers were more likely to be discriminated against (PR = 1.9, 95% CI: 1.6, 2.3; aPR = 2.0, 95% CI: 1.7, 2.4), rejected by family (PR = 1.8, 95% CI: 1.4, 2.4; aPR = 1.8, 95% CI: 1.3, 2.4) and physically abused (PR = 3.3, 95% CI: 2.0, 5.2; aPR = 4.2, 95% CI: 2.6, 6.8) compared to male sex workers. Transgender sex workers were equally as likely to have experienced forced sex as male sex workers.

Discussion

Sex work, current or past, was nearly ubiquitous among transgender women recruited for a behavioral survey in Guatemala City. Transgender sex workers were significantly more likely to have been discriminated against, physically abused and forced to have sex compared to non-sex workers and compared to male sex workers. Moreover, transgender sex workers used illicit drugs and were rejected by family more often than male sex workers. The behaviours and adverse life events under study have all been linked to an increased risk of HIV infection.^{54,58,103}

The combination of substance abuse, violence and discrimination that affects transgender and male sex workers in Guatemala has been previously described as a syndemic.^{55,72,196} The term syndemic has been used to describe the co-occurrence of substance abuse, HIV, and violence as a set of enmeshed and mutually enhancing health problems that work together in a context of deleterious social and physical conditions to increase vulnerability.¹³⁴ The syndemic even exists as a dose-response relationship between the number of adverse life events among transgender women and the HIV prevalence, where

adverse life events include ever having experienced physical violence, having been in jail, having been raped and having low literacy.¹⁹⁷

The discrimination faced by transgender women in Guatemala was explored in a qualitative study where participants expressed fear of discrimination related to gender identity, sexual behaviors and HIV/STI diagnosis as a barrier to accessing sexual health services and fear of rejection by peers for being diagnosed with HIV.¹⁵ HIV-related stigma interacts and builds on societal judgment of certain behaviors, lifestyles or characteristics as undesirable or 'wrong,' including homosexuality, bisexuality and sex work.¹⁹⁸ Stigma and discrimination towards transgender women are underlying determinants that indirectly increase HIV risk in addition to a deleterious effect on mental health and suicidal inclination.^{68,99,106,199,200}

Discrimination, physical abuse, forced sex, drug and alcohol use affect health negatively regardless of whether they increase a person's risk of HIV infection. Such adverse life events can lead to anxiety, depression, and other mental health disorders in this case for transgender women.^{55,68,99-102} Programs, whether designed to prevent HIV infection or improve other area of health and well-being should include services to address mental health and substance abuse issues.

The cross-sectional nature of this study makes it impossible to disentangle cause and effect in relation to adverse life events, sex work and transgender identity. Many possible pathways exist in which the different adverse life events precede or follow initiation of sex work and people go in and out of sex work depending on their financial needs. This analysis can only point to associations between transgender people, sex work and the behaviors and adverse life events under study.

Ideally, we would have made transgender women who did not engage in sex work a reference group. However, the sample from this population was too small and we excluded those few participants from the analysis rather than group them with the cisgender non-sex workers. As part of the decision on

how to categorize transgender non-sex workers we looked at their lifetime history of sex work. Half of the transgender women who had not received money for sex in the past year had engaged in sex work at some point in their lives leading to the conclusion that the transgender non-sex workers were dissimilar to the male non-sex workers but had not recently engaged in sex work and therefore could not be defined as transgender sex workers.

This study did not collect biomarkers needed to confirm the increased HIV risk among transgender sex workers but another study in Guatemala showed that the prevalence of HIV among transgender women was two and half times that among MSM.¹⁶⁷

Most bio-behavioral studies of MSM recruit transgender women and sex workers as part of the sample but do not always report the HIV prevalence, behaviors or prevention coverage separately for these diverse populations. To understand the diversity of risk among the MSM-umbrella term, researchers should report data for different subpopulation such as transgender women and sex workers.

Given the available research on HIV risk among transgender women, prevention programs should prioritize this population and tailor interventions to their needs. Condoms and behavior change interventions have been promoted since the beginning of the HIV epidemic but HIV incidence among transgender women continues to rise.²⁰¹⁻²⁰⁵ In recent years, interventions such as community empowerment, = substance use and mental health services, HIV testing and immediate ART initiation (test and treat), pre-exposure prophylaxis (PrEP), post-exposure prophylaxis (PEP) and rectal microbicides have been either recommended or are under study.^{206,207}

To address underlying determinants of HIV infection such as discrimination in education and employment settings and lack of support from family, prevention interventions for transgender women in Guatemala and other similar contexts should focus on skill-building, insertion into the labor market

and support networks. Mass media campaigns should address stigma and discrimination towards people of diverse sexual identities and people with HIV and stigma reduction interventions in health centers are needed to further reduce barriers to care.

Tables and Figures:

Table 5. Demographics by transgender identity and recent history of sex work, MSM and transgender women, Guatemala City

	Transgender sex workers n (%) (n = 122)	Male sex workers n (%) (n = 284)	Non-sex workers n (%) (n = 651)	p
Age				
18-24	59 (48.4)	139 (48.9)	267 (41.0)	0.2
25-34	43 (35.2)	101 (35.6)	257 (39.5)	
35+	20 (16.4)	44 (15.5)	127 (19.5)	
Education				
primary or less	31 (25.4)	78 (27.5)	42 (6.5)	<0.0001
some or completed secondary	81 (66.4)	183 (64.4)	320 (49.2)	
some or completed university	10 (8.2)	23 (8.1)	288 (44.3)	
Monthly income				
<\$300	50 (43.1)	193 (69.9)	239 (37.3)	<0.0001
\$300-500	49 (42.2)	67 (24.3)	227 (35.5)	
\$501-800	11 (9.5)	11 (4.0)	87 (13.6)	
>\$800	6 (5.2)	5 (1.8)	87 (13.6)	
Sexual orientation				
Heterosexual	0 (0.0)	36 (12.9)	25 (3.9)	<0.0001
Bisexual	0 (0.0)	124 (44.3)	199 (30.7)	
Gay	0 (0.0)	120 (42.9)	425 (65.5)	
Transgender	122 (100.0)	0 (0.0)	0 (0.0)	

Table 6. Crude and adjusted analysis for drug and alcohol use as associated with transgender identity and recent history of sex work

	Used illicit drugs*					Binge drinking episode**				
	n (%)	PR	95% CI	aPR†	95% CI	n (%)	PR	95% CI	aPR†	95% CI
Transgender sex worker	53 (43.8)	2.5	1.9, 3.2	2.6	2.0, 3.5	49 (40.2)	1.4	1.1, 1.8	1.5	1.2, 2.0
Male sex worker	97 (34.3)	1.9	1.5, 2.4	2.1	1.7, 2.8	113 (39.8)	1.4	1.2, 1.7	1.6	1.3, 1.9
Non- sex worker	115 (17.8)	1 (ref)		1 (ref)		182 (28.0)	1 (ref)		1 (ref)	
Transgender sex worker	53 (43.8)	1.3	1.0, 1.7	1.2	0.9, 1.6	49 (40.2)	1.0	0.8, 1.3	1.0	0.7, 1.3
Male sex worker	97 (34.3)	1 (ref)		1 (ref)		113 (39.8)	1 (ref)		1 (ref)	

* in the past 12 months; ** in the past 7 days; †adjusted for age, education and monthly income

Table 7. Crude and adjusted analysis for mistreatment, forced sex and social exclusion as associated with transgender identity and recent history of sex work

	Discriminated due to sexual identity*					Rejected by family				
	n (%)	PR	95% CI	aPR**	95% CI	n (%)	PR	95% CI	aPR**	95% CI
Transgender sex worker	89 (73.0)	2.9	2.4, 3.4	2.7	2.2, 3.2	55 (45.1)	1.3	1.0, 1.6	1.3	1.0, 1.6
Male sex worker	110 (38.7)	1.5	1.3, 1.9	1.3	1.1, 1.6	71 (25.2)	0.7	0.6, 0.9	0.7	0.6, 0.9
Non- sex worker	165 (25.3)	1 (ref)		1 (ref)		225 (34.8)	1 (ref)		1 (ref)	
Transgender sex worker	89 (73.0)	1.9	1.6, 2.3	2.0	1.7, 2.4	55 (45.1)	1.8	1.4, 2.4	1.8	1.3, 2.4
Male sex worker	110 (38.7)	1 (ref)		1 (ref)		71 (25.2)	1 (ref)		1 (ref)	

	Physically abused*					Forced to have sex*				
	n (%)	PR	95% CI	aPR**	95% CI	n (%)	PR	95% CI	aPR**	95% CI
Transgender sex worker	35 (28.7)	9.3	5.6, 15.6	7.3	4.3, 12.4	15 (13.5)	6.5	3.0, 14.2	7.5	3.1, 18.2
Male sex worker	25 (8.8)	2.9	1.6, 5.1	1.7	1.0, 3.1	28 (12.5)	6.0	3.0, 12.2	6.1	2.7, 14.2
Non- sex worker	20 (3.1)	1 (ref)		1 (ref)		10 (2.1)	1 (ref)		1 (ref)	
Transgender sex worker	35 (28.7)	3.3	2.0, 5.2	4.2	2.6, 6.8	15 (13.5)	1.1	0.6, 1.9	1.2	0.7, 2.3
Male sex worker	25 (8.8)	1 (ref)		1 (ref)		28 (12.5)	1 (ref)		1 (ref)	

* In the past 12 months; ** adjusted for age, education and monthly income

CHAPTER SIX: CONCLUSIONS

Globally, transgender women and men who have sex with men (MSM) are 50 and 19 times, respectively, as likely to be infected with HIV compared to the general population.^{1,2} Despite knowledge of effective interventions to prevent HIV infection, the incidence among MSM and transgender women continues to rise. The purpose of this dissertation was to: 1) describe the population missed through venue-based sampling and illustrate how data on venues frequented by MSM and transgender women can be used to prioritize delivery of HIV prevention services; 2) identify contextual factors that contribute to HIV risk among transgender and male sex workers who have sex with men.

Summary of Findings

The first aim of this dissertation was designed to explore the differences between the men who have sex with men and transgender populations reached through venues, i.e. time-location sampling, (TLS) and those reached through respondent-driven sampling (RDS) who do not frequent venues. Both TLS and RDS have advantages and disadvantages in the information they provide and the logistics of implementation. The differences are potentially context- and population-specific. In Latin America, RDS appears to reach MSM, who have sex with both men and women, identify as heterosexual or bisexual, are older and have a lower level of education. The RDS non-venue goers were more likely to have concurrent partners than people reached through TLS. In this analysis, access to prevention services was similar in the two samples.

In RDS, each participant can recruit up to three peers to participate in the study where the first recruitment waves are closest to the seeds or initial participants chosen by the investigators and the last waves are most distant. In Malawi, the percent of MSM who had been tested for HIV more than once

decreased in subsequent RDS recruitment waves from 31 to 12%. In addition, the percent of MSM unaware that they were HIV-positive increased across waves in Malawi, Swaziland and Lesotho.¹⁸¹ The analysis from three African countries supports the hypothesis that RDS initially recruits men who are more easily reached and seek HIV prevention services but eventually reaches men who are less likely to access services. It is also indicative that HIV prevalence decreased across waves, in Malawi and Lesotho, supporting the idea that MSM farthest from the initial recruits are less likely to be exposed to HIV. Prevention programs need to prioritize subpopulations at highest risk and as coverage is adequate, expand to reach subpopulations at lower risk and with less access to prevention services.

The first aim also compared the MSM and transgender population recruited at different types of venues as part of the TLS study. This analysis is an example of how HIV programs can collect data about different venues where the target population can be reached including service coverage and risk characteristics of people at different types of venues.

In our analysis, clubs, streets and parks known to be visited by MSM and transgender women had the highest yields. While the majority of men approached at clubs were truly MSM, parks and streets were mixed sites with many men from the general population complicating interventions that wish to target MSM exclusively. NGOs, saunas, and hotels are low volume venues but most men at those sites were MSM, facilitating targeted service delivery.

If programs wish to reach people at highest risk, it is important to know that MSM and transgender women identified at streets, parks, saunas and NGOs had more sexual partners or were more likely to have received money for sex compared to participants from bars, indicating a higher risk vs. lower risk populations.

To reduce coverage gaps, programs should consider that MSM and transgender women at restaurants, cafes, saunas and hotels were less likely to be tested for HIV or have received free

condoms. Given that all MSM and transgender women recruited at venues are in theory, reachable, coverage for prevention services is expected to be high. Prevention programs in Guatemala can use this analysis as a baseline and set the bar higher as coverage improves. For example, in addition to HIV testing the past year, programs can measure repeat testing, awareness of HIV-positive status and receipt of a package of prevention services to ensure people at venues are receiving the recommended services from national or WHO guidelines.

As a recommendation for programs moving forward, venue-based sampling and respondent-driven sampling (RDS) can and should be used to identify subpopulations at increased risk of HIV, assess coverage of HIV prevention and treatment services and deliver services to populations and geographical areas with the greatest gaps in coverage. As new point-of-care tests for CD4 and viral load are introduced, outreach workers and clinics closer to the populations' home can offer a better follow-up for people living with HIV. Focusing on the areas where the HIV epidemic is concentrated, identifying the places where services are lacking and implanting HIV testing, treatment and support in those areas are steps towards achieving more efficient and effective HIV prevention programs.

The second aim is linked to the first in that it sought to identify subpopulations at increased risk of HIV, people who most need HIV prevention and treatment services. Globally, the prevalence of HIV was highest among transgender sex workers (27%), followed by transgender non-sex workers and male sex workers (15%) and female sex workers (5%).¹⁸⁸ Male-to-female transgender sex workers, male sex workers who have sex with men and MSM non-sex workers were the subpopulations from our analysis. First and foremost, the two recruitment arms recruited 142 transgender women or 13% of the study population in a study that was not designed to oversample transgender women. Of those transgender women, almost all had received money for sex at some point in their lives and 86% had received money for sex in the past 12 months, meeting our definition for current sex work. The fact that an

overwhelming majority of the transgender women sampled were also sex workers is an obvious sign of increased risk among this population.

Overall, transgender and male sex workers were more likely to engage in risk behaviors or be affected by underlying risk factors than non-sex workers. Transgender and male sex workers were more likely to have used illicit drugs and consumed alcohol in higher quantities, behaviors associated with condomless anal intercourse and HIV infection, compared to MSM who had not received money for sex.^{16,45,46,48-63}

The interconnectedness of substance abuse, educational and economic opportunity, stigma, discrimination and violence make it difficult to pinpoint specific factors or behaviors that put transgender women at increased risk of HIV. Researchers have introduced the term syndemic to describe the co-occurrence of the societal and health problems faced by transgender women and men who have sex with men in some contexts.^{55,72,134,135,196}

In our analysis, both transgender and male sex workers faced higher levels of discrimination, physical abuse and forced sex compared to men who had not received money for sex. It is easier for cisgender MSM to hide their sexual identity from the public and therefore protect themselves from discrimination and harassment. Transgender and male sex workers, most of whom meet their clients in the street are subject the constant harassment, discrimination, violence and rape. Transgender and male sex workers, who can be reached through parks, streets, saunas, hotels, NGOs and social networks, are in need of violence prevention, psychosocial and other basic HIV prevention interventions.

Public Health Implications

In its consolidated guidelines on HIV prevention, diagnosis treatment and care for key populations, which include transgender women and MSM, the WHO recommends:²⁰⁶

- a. supportive legislation, policy and financial commitment, including decriminalization of certain behaviors of key populations
- b. addressing stigma and discrimination, including by making health services available, accessible and acceptable
- c. community empowerment
- d. addressing violence against people from key populations

Health sector interventions should include:

- a. comprehensive condom and lubricant programming
- b. harm reduction interventions for substance use
- c. behavioral interventions
- d. HIV treatment and care
- e. prevention and management of co-infections and other co-morbidities, including viral hepatitis, tuberculosis and mental health conditions.
- f. sexual and reproductive health interventions (STI screening, diagnosis and treatment)
- g. pre-exposure prophylaxis (PrEP)
- h. post-exposure prophylaxis (PEP)
- i. harm reduction programs for people who inject drugs

People living with HIV should have access to:

- a. linkages to care, follow-up and ART initiation
- b. adherence programs, support groups
- c. viral load monitoring

In 2015, the WHO expanded its recommendation for ART initiation to all people with HIV regardless of CD4 count and PrEP for HIV negative individuals at substantial risk of HIV infection.²⁰⁸

Governmental and non-governmental organizations providing HIV prevention and treatment services to transgender and MSM populations should continue to identify and pilot interventions to improve the availability, acceptability and accessibility of HIV prevention services mentioned above. Mobile and home-based service delivery are strategies to improve access for people who do not wish to come to a health center. Programs to improve the friendliness of established clinics towards the key populations such as sensitization of health care workers will improve uptake among the population. Mapping of venues where transgender women and MSM socialize or work and the presence of HIV prevention services will help identify gaps in services.

An adequate programmatic response to the high rates of HIV transmission that often cluster in specific places or among specific populations requires dynamic data collection and analysis. In many cities around the world, organizations have conducted integrated bio-behavioral surveillance studies (IBBS) to assess the burden of HIV among specific populations and in some areas the surveys have been repeated to investigate trends over time. IBBS are typically expensive, conducted by foreign universities, NGOs or companies and depend on international donors. The information collected through such surveys, including the data from this analysis is valuable for program planning but not consistently integrated into countries' routine surveillance systems. Once collected, IBBS data are sometimes ignored, forgotten or underutilized due to lack of technical expertise or political will. In general, a gap between research or surveillance data and programs or service delivery needs to be bridged so that data collection and services are tightly interconnected if not one in the same.

Data can and should be combined in innovative ways, including with geographical information, to produce a more detailed and vivid understanding of the HIV epidemic. To take full advantage of these new opportunities requires enhancing HIV-related data collection and analysis systems, working with affected communities and key populations to achieve high-quality data and analysis and ensuring that

the information is gathered and used in ways that support and do not expose people to victimization and harassment.

The benefits of data on populations at increased risk are innumerable but the potential harms or unintended consequences of data collection must be taken into account. Mapping of venues where transgender women and MSM work or socialize could call unwanted attention to the populations and increase stigma and violence.^{209,210} Criminalization of same-sex behavior or gender transition reinforces stigma and discrimination against these populations, and acts to legitimize violence, extortion and discrimination against them by police as well as private actors.²¹¹ The fear of arrest or police abuse drives people who use drugs away from lifesaving HIV services, and fosters risky practices. In summary, organizations that collect data or provide services to transgender women and MSM should consider the level of stigma and laws that criminalize same sex behavior, sex work or nonconforming gender identities and always involve the population in any data collection or programmatic activity from the start.^{212,213}

As part of the planning stage, organizations that will collect data on MSM should consider the heterogeneity of the MSM umbrella term and potential subpopulations for which stratified data will be needed. Potential populations or subpopulations include transgender women, sex workers, bisexual-, gay- and heterosexual-identifying MSM, people who inject drugs and people in prisons or closed settings. A formative assessment should be conducted to identify subpopulations in the local context before conducting quantitative data collection, monitoring or evaluation. Stratification of data by subpopulation allows for tailoring of services to a population's needs, program planning and justification of additional services for a specific population.

Future Research Directions

Future research should focus on acceptability, feasibility and long term side effects of PrEP for MSM and transgender women. For MSM and transgender women with HIV, research should evaluate interventions to improve adherence to ART. Community engagement and interventions to empower populations at increased risk and reduce stigma towards MSM and transgender women should also be implemented and evaluated. New types of condoms should be designed and their acceptability studied. Vaccine research should continue until successful.

Conclusions

Routine surveillance or alternatively, IBSS, is needed to identify subpopulations at increased risk of HIV and monitor coverage of HIV prevention and treatment services. Surveillance should document not only the prevalence of HIV and other STI but also risk factors such as condom use and number of partners and underlying determinants such as discrimination, violence, drug and alcohol use.

Most transgender women in Guatemala City receive money for sex and are affected by adverse life events that act as underlying determinants of HIV infection. Programs should include psychosocial interventions for substance abuse and prevention of violence towards transgender women. Venues where transgender women, male sex workers and MSM can be reached are low-hanging fruit for HIV prevention programs and services offered should follow global guidance for key populations at increased risk.

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